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Cottonwood

(*Populus* species)

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The name cottonwood is applied to 10 or 12 closely related species of trees that grow in the United States, of which eastern cottonwood, swamp cottonwood, and black cottonwood are the most important. Eastern cottonwood is widely distributed throughout the eastern half of the United States. Swamp cottonwood is also an eastern tree but is confined largely to lowlands. Black cottonwood grows in the Northwestern States and in California. All of the cottonwoods require considerable soil moisture for their best growth. Under favorable conditions the cottonwoods grow very rapidly, especially for the first 30 or 40 years, and ultimately form large trees sometimes 130 feet in height and from 4 to 6 feet in diameter. Eastern cottonwood is a rather short-lived tree and after 40 or 50 years frequently becomes defective unless grown under the most favorable conditions. Swamp cottonwood generally remains sound for a considerably longer period. Black cottonwood is the longest-lived of the three.

The wood of the three species is quite similar in appearance and properties. It is light in weight and color, has a uniform texture and fairly straight grain, but is not strong and decays quickly in contact with the ground. Cottonwood, in the form of both lumber and veneer, is used principally for boxes and crates. It is also used for pulpwood and excelsior. The local consumption for fuel is large.

Nomenclature.—Table 1 gives the names of the cottonwoods of greatest commercial importance.

TABLE 1.—*Cottonwoods of greatest commercial importance*

Common name	Botanical name	Other names
Eastern cottonwood.....	<i>Populus deltoides</i> and varieties.....	Cottonwood. Cotton-Tree. Carolina poplar. Necklace poplar. Whitewood.
Swamp cottonwood.....	<i>Populus heterophylla</i>	Cottonwood. River cottonwood. Black cottonwood. Swamp poplar.
Black cottonwood.....	<i>Populus trichocarpa</i> and variety <i>hastata</i>	Cotton-tree. Cottonwood. Balm cottonwood.

The remaining cottonwoods are of comparatively little commercial importance. They include: Fremont cottonwood (*Populus fremontii*, syns. *P. arizonica* *P. macdougalii*), plains cottonwood (*P. sargentii*),

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narrowleaf cottonwood (*P. angustifolia*), lanceleaf cottonwood (*P. acuminata*), Palmer cottonwood (*P. palmeri*), Texas cottonwood (*P. texana*), and Rio Grande cottonwood (*P. wislizeni*).

Distribution and growth.—Eastern cottonwood grows in small scattered stands or in mixture with other species, from southern New England west to the southern part of the Lake States and south to northern Florida and into eastern Texas, except in the highlands of the Appalachian Mountains from New York to Georgia and in the Ozark Mountains in Arkansas and Missouri. (See fig. 1.) It can endure climatic conditions of considerable diversity but needs full light for proper development. It grows best in fairly good soil with plenty of soil moisture. Heights of 75 to 85 feet and diameters of 2 to 3 feet are not unusual in mature trees. The growth is rapid in early life, and under favorable conditions annual increases of 5 feet in height and 1 inch in diameter are common. The rate of growth falls off rapidly after 30 to 40 years, and a tree seldom lives over 80 years. Eastern cottonwood is frequently planted for windbreaks and sometimes for lumber, pulpwood, and fuel. Yields per acre of 30,000



FIGURE 1.—Range of eastern cottonwood (*Populus deltoides* and vars.).

board feet of lumber and 50 cords of pulpwood or fuel wood from 35-year old cottonwood plantations are not unusual.

Swamp cottonwood grows along the Atlantic coast from Connecticut to Florida and from Ohio and Indiana southward in the lowlands of the Ohio River and the Mississippi River to eastern Texas and southern Louisiana. (See fig. 2.) It needs a moist, deep soil and plenty of sunlight. Reproduction from seed is unsatisfactory under even partial shade. The tree grows best on the edges of swamps and in low-lying areas near tidewater. The early growth is rapid, and under favorable conditions trees 40 years old reach heights of over 100 feet and diameters between 2 and 3 feet. After about 40 years there is little further height growth and comparatively slow diameter growth. Trees do not generally remain sound after they reach an age of 80 years.

Black cottonwood grows in the west coast States and in western Montana, northern Idaho, and western Nevada. (See fig. 3.) Like eastern cottonwood and swamp cottonwood, it is very intolerant of shade and needs a wet or moist soil. It grows best at lower levels on river bottoms and sandbars, where it reaches a diameter of 3 to 4 feet, and even more, and a height of 80 to 125 feet. The early growth is rapid, later growth becomes much slower. Black cottonwood is a somewhat longer lived tree than eastern or swamp cottonwood, probably reaching an age of 150 years before deterioration begins.

The remaining native cottonwoods grow largely west of the Mississippi River. All are rapid-growing, rather short-lived, and need abundant sunlight and soil moisture for their best development.

Supply.—Information is not available on which to base a reliable estimate of the total stand of cottonwood saw timber in the United States.

A forest survey in the Southeastern States¹ completed in 1937 showed a stand of 1,775,500,000 board feet of eastern and swamp cottonwood in the Mississippi River Delta in Arkansas, Mississippi, and Louisiana. In the remainder of the area included in the survey, not enough cottonwood was encountered to justify listing as a separate species. Additional supplies of eastern and swamp cottonwood in other parts of their ranges not included in the survey, especially in Missouri and nearby States, probably amount to about twice the stand in the Mississippi River Delta. This would bring the stand in the eastern United States to about 5,300,000,000 board feet.²

Forest surveys in the Northwestern States³ showed that the bulk of the black cottonwood was located in western Washington and Oregon, and in western Montana. The entire stand of black cottonwood in the western part of the United States was estimated at nearly 700,000,000 board feet.

The total stand of eastern, swamp, and black cottonwood saw timber in the United States is estimated at approximately 6,000,000,000 board feet. This is itemized in table 2.

¹ Conducted by the Southern Forest Experiment Station of the U. S. Forest Service. The following States were included: Alabama, Arkansas (three-fourths of area), Georgia, Florida, Mississippi, South Carolina (one-fourth of area), Louisiana, Texas (extreme east), and Oklahoma (one-tenth of area).

² An estimate in THE SOUTHERN HARDWOODS—COTTONWOOD, SOUTHERN PRODUCERS, INC., South. Lumberman 162 (2040): 29, illus., 1941, places the stand of cottonwood in the South at 7 billion board feet.

³ Conducted by the Pacific Northwest Forest and Range Experiment Station and the Northern Rocky Mountain Forest and Range Experiment Station (1930-40).

TABLE 2.—*Estimated stand of cottonwood in United States*

Region	Stand (lumber tally)	Region	Stand (lumber tally)
Eastern United States:	<i>Board feet</i>	Western United States:	<i>Board feet</i>
Louisiana.....	¹ 313, 600, 000	Western Oregon.....	³ 163, 000, 000
Arkansas.....	¹ 735, 900, 000	Western Washington.....	³ 178, 900, 000
Mississippi.....	¹ 726, 000, 000	Eastern Oregon.....	⁴ 18, 700, 000
Other eastern States.....	² 3, 500, 000, 000	Eastern Washington.....	⁵ 69, 968, 000
Eastern and swamp cotton- wood.....	5, 275, 500, 000	Northern Idaho.....	⁶ 37, 500, 000
		Western Montana.....	⁶ 159, 900, 000
		California.....	80, 000, 000
		Black cottonwood.....	707, 968, 000
		Total.....	5, 983, 468, 000

¹ See footnote 1, p. 3.

² This is based on the assumption that the stand in the Mississippi River Delta (Louisiana, Arkansas, and Mississippi) represents about one-third of the total stand of cottonwood in the eastern part of the United States.

³ ANDREWS, H. V., and COWLIN, R. W. FOREST RESOURCES OF THE DOUGLAS-FIR REGION. U. S. Dept. Agr. Misc. Pub. 389, 169 pp., illus. 1940.

⁴ COWLIN, R. W., BRIEGLEB, P. A., and MORAVETS, F. W. FOREST RESOURCES OF THE PONDEROSA PINE REGION. U. S. Dept. Agr. Misc. Pub. 490, 99 pp., illus. 1942.

⁵ See footnote 4 above. See also U. S. FOREST SERVICE, NORTHERN ROCKY MOUNTAIN FOREST and RANGE EXPERIMENT STATION:

FOREST STATISTICS, PEND OREILLE COUNTY, WASHINGTON. Forest Survey Release 2, 24 pp., illus. 1937. [Processed.]

FOREST STATISTICS SPOKANE COUNTY, WASHINGTON. Forest Survey Release 4, 24 pp., illus. 1937. [Processed.]

FOREST STATISTICS STEVENS COUNTY, WASHINGTON. Forest Survey Release 5, 24 pp., illus. 1937. [Processed.]

U. S. FOREST SERVICE, NORTHERN ROCKY MOUNTAIN FOREST and RANGE EXPERIMENT STATION:

FOREST STATISTICS FOR NORTHERN IDAHO. Forest Survey Statis. Serv. 10, illus. 1941. [Processed.]

HIGHLIGHTS OF THE FOREST SITUATION IN WESTERN MONTANA. Forest Survey Statis. Serv. 14, illus. 1943. [Processed.]

Production of lumber.—The term “cottonwood” as used in the lumber production statistics of the Bureau of the Census includes not only the eastern, swamp, and black cottonwoods, but also the aspens and balsam poplar. The production of “cottonwood” lumber decreased irregularly from a maximum of 421,575,000 board feet in 1899 ⁴ to a minimum of 48,886,000 board feet in 1932. Production in 1940 amounted to 153,562,000 board feet; in 1942 it was 282,562,000 board feet and in 1943 243,768,000 board feet. The average annual cut of cottonwood lumber for the 10-year period 1934–43 was approximately 167,000,000 board feet. Of this amount, about 72,000,000 board feet came from the Southeastern States and was all cottonwood, and about 24,000,000 came from the Central States, including Missouri and Tennessee, and was largely cottonwood. It is estimated that cottonwood lumber from other parts of its range in the Eastern States would bring the average annual production in recent years to approximately 95,000,000 board feet. The most important producing States for eastern and swamp cottonwood are Mississippi, Arkansas, Louisiana, and Missouri.

Black cottonwood lumber comes largely from Oregon. The cut is comparatively small. The average annual production in recent years has been somewhat less than 7,000,000 board feet.

The average annual cut of the three cottonwoods for lumber in recent years is estimated roughly at 102,000,000 board feet.

Veneer.—The consumption of cottonwood for veneer during the period 1919–39 ⁵ ranged from a minimum of 27,882,000 feet log scale

⁴ The first year for which statistics on the production of cottonwood lumber are available.

⁵ The latest year for which statistics are available.



FIGURE 2.—Range of swamp cottonwood (*Populus heterophylla*).

in 1921 to a maximum of 54,081,000 feet in 1937. Consumption in 1939 was 52,738,000 feet, which represented about 4.5 percent of the total consumption of all species for veneer and placed cottonwood fifth among veneer woods in amount consumed. The average annual consumption for the past few years was approximately 49,000,000 feet log scale, equivalent to 58,000,000 board feet.⁶

Pulpwood.—The consumption of cottonwood for pulpwood during the 5-year period 1936–40 ranged from a maximum of 74,580 cords in 1940 to a minimum of 40,996 cords in 1938. The average annual consumption for this period was approximately 61,000 cords, equivalent to 18,300,000 board feet.⁷ Consumption of cottonwood pulpwood in 1940 was less than 1 percent of the total (domestic).

Excelsior.—The excelsior industry consumed an average of about 77,000 cords of cottonwood each year during the period 1927–35.⁸ A large proportion came from Michigan and Wisconsin. Probably two-thirds was aspen and one-third—roughly 25,000 cords, equivalent to 7,500,000 board feet—cottonwood.

⁶ Overrun in converting feet log scale to board feet of lumber is taken as 20 percent.

⁷ A cord of pulpwood or excelsior wood is assumed to contain 300 board feet.

⁸ No later statistics for excelsior available.

The combined average annual cut of the three cottonwoods for lumber, veneer, pulpwood, and excelsior in recent years has been about 186,000,000 board feet. The cut of the cottonwoods for fuel and other local uses is undoubtedly quite large, but records of production or consumption are not available. The total average annual cut of eastern, swamp, and black cottonwood for all purposes for the last few years is estimated roughly at 200,000,000 board feet.



FIGURE 3.—Range of black cottonwood (*Populus trichocarpa* and var. *hastata*).

Properties.—The heartwood of the three cottonwoods—eastern, black, and swamp—is grayish white to light brown. The whitish sapwood, which may be wide or narrow, is not clearly defined and merges more or less gradually with the heartwood. The annual rings are inconspicuous but can be distinguished. The wood is comparatively uniform in texture and generally straight-grained, although cross-grain is not uncommon. It has a characteristic sour odor when moist but is odorless when seasoned. Eastern cottonwood is moderately light in weight,⁹ moderately weak in bending and compression,

⁹ The average weight of eastern cottonwood in a thoroughly air-dry condition (12 percent moisture) is 28 pounds per cubic foot.

moderately limber, moderately soft, and moderately 'ow in ability to resist shock. Black cottonwood is slightly below eastern cottonwood in most of its strength properties, as would be expected from its slightly lighter weight.¹⁰ Tests to determine the strength properties of swamp cottonwood have not been made. It is highly probable that this wood has properties quite similar to eastern cottonwood. Both eastern and black cottonwood have a moderately large shrinkage.

The cottonwoods require careful seasoning if warping is to be avoided. They rank low in durability when used under conditions favorable to decay. They are classed with the woods that glue satisfactorily with different glues, provided moderate care is used in the operation. Cottonwood is rather difficult to work with tools without producing chipped or fuzzy grain. It is low in nail-holding ability, but does not split easily in nailing. The wood has a good reputation for holding paint, although no definite information is available.

Cottonwood can be readily reduced to paper pulp by the soda process.¹¹ The fibers are longer than those of aspen (a wood long used for paper pulp), and the pulp is easily bleached. Cottonwood can also be easily reduced to mechanical pulp but, like aspen, requires considerably more power than spruce and produces a weaker pulp.

Principal uses.—Cottonwood is used principally for lumber, veneer, pulpwood, excelsior, and fuel. The lumber and veneer go largely into boxes and crates. The light weight of cottonwood and its ability to take nails without splitting, combined with a good color for stenciling, and lack of odor, make it suitable for a wide variety of containers. Other uses for cottonwood lumber and veneer include furniture (interior parts); dairy and poultry supplies, particularly, coops and brooders; vehicles (motor and nonmotor); agricultural implements; and woodenware, principally cutting boards, breadboards, meat boards, and tubs and pails for packing butter and other food products.

Cottonwood pulpwood is used in the manufacture of high-grade book paper. The light color, fairly straight grain, and uniform texture of cottonwood make it well fitted for excelsior. Cottonwood makes a hot, quick fire but burns up very rapidly. It is much used for fuel in the plains region west of the Mississippi, where it is often the principal, and sometimes the only, wood available.

Table 3 gives the amounts of cottonwood used in the manufacture of wooden products in 1933 and 1940.¹² The tabulation includes cottonwood in the form of lumber, veneer, and logs and bolts.

¹⁰ The average weight of black cottonwood in a thoroughly air-dry condition (12 percent moisture) is 24 pounds per cubic foot.

¹¹ Six processes are used commercially in making paper pulp from wood. One is the mechanical or ground-wood process, in which the wood is reduced to pulp on a grindstone. The yield approaches 100 percent of the weight of the wood. Four are chemical processes—the sulfite, sulfate, soda, and neutral sulfite. They depend upon the dissolving action of chemical reagents which remove essentially all of the binding material (lignin) surrounding the cellulose fibers and leave them in a fairly pure state. The removal of the lignin is accomplished by cooking the wood chips with the proper chemical under steam pressure. The yield of pulp is about one-half the weight of the wood. In a sixth process, the semichemical, part of the lignin is removed by chemical means, and the resultant pulp, containing some lignin, is further refined by mechanical means. The yield of semichemical pulp is intermediate between the yields obtained with the mechanical process and the chemical processes.

¹² These are the only years for which such information is available for cottonwood as a separate wood. See Lumber Used in Manufacture—1933 and 1940. (Summary tables.) U. S. Forest Service Preliminary Statistics. Forest Survey of the United States.

TABLE 3.—*Cottonwood used in the manufacture of wooden products*

[Thousands of board feet]

Product	1933	1940
Agricultural implements.....	250	2,761
Boxes, baskets, and crating.....	97,996	124,642
Boxes, cigar and tobacco.....	77	1
Car construction and repair.....	17	201
Caskets and burial boxes.....	11	11
Conduits, pumps, and wood pipe.....	2,820	6,805
Dairy, poultry, and apiary supplies.....	48	11
Fixtures.....	9,798	6,212
Furniture.....	25	142
Instruments, musical.....	436	163
Laundry appliances.....	1,316	1
Radio and phonograph cabinets.....	64	55
Refrigerators.....	1	74
Sash, doors, general millwork.....	100	249
Sewing machines.....	18	3
Ship and boat building.....	1,500	632
Toys.....	288	2,123
Trunks and valises.....	164	344
Vehicles, motor.....		
Vehicles, nonmotor.....		
Woodenware and novelties.....		
Total.....	¹ 114,918	¹ 144,429

¹ Includes cottonwood in the form of lumber, veneer, and logs and bolts in the following amounts:

	1933 Board feet	1940 Board feet
Lumber.....	82,813,000	98,538,000
Veneer.....	13,201,000	29,629,000
Logs and bolts.....	18,904,000	16,262,000

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